ing of the Bronze Age, he considers the crescent-shaped earthenware articles rising from a flat base, found in several of the villages, to be "suggestive of religious ideas" instead of being head rests. The latter and more popular view seems to me to be most probable. Again, our author says that "the lake-dwellings of the Bronze Age are built in deeper water, and consequently further from the shore, than those of the Stone Age" (p. 538). Surely they were built further from the shore for purposes of defence against the better weapons, and consequently in deeper water. These, however, are minor points of criticism in a work which will be of great service to archæologists. Dr. Munro is to be congratulated on his success in completing a most difficult task.

W. BOYD DAWKINS.

OUR BOOK SHELF.

Colour in Woven Design. By Roberts Beaumont, Professor and Director of the Textile Department in the Yorkshire College. Pp. xxiv. and 440. (London: Whittaker and Co., 1890.)

AMONGST the merits which this book may possess (and we do not deny that they are considerable), elegance and accuracy of diction cannot be reckoned. This criticism is justified by the occurrence of countless phrases, such as these—"Non-luminous bodies are incompetent of emitting undulations that convey any coloured appearance to the mind"; "linear and curvilinear lines"; and "in the rose there is displayed in perfection all the various modifications in tint and shade to which this important colour (red) is susceptive." And we cannot endorse in all particulars the exposition of the theories of colour given by Prof. Beaumont. For instance, he contrasts what he calls the "light theory of colours" with the "pigment theory," and then, speaking of the latter, says: "Scientifically, it is no more a correct scheme than the light theory is applicable to the industries or to the mixing of paints." But surely the theory of Young, Maxwell, and Helmholtz is as applicable to the results obtained by mixing pigments or coloured fibres, as it is to the results of mingling coloured lights. Yet, while the author writes, on p. 20, "many of the mixtures obtained by this system (that adopted by Chevreul and Brewster) are diametrically opposed to the laws of physics," he proceeds to explain the chromatic phenomena of textiles by its aid. It is needless to urge how deeply Prof. Beaumont's acceptance of the red-yellow-blue triad of primaries vitiates his reasoning as to the effects of contrast, as to the question of the existence of tertiary hues, and as to the true complementaries.

When, however, we turn to the practical or technical sections of this hand-book, we find much information of sterling value. Here Prof. Beaumont is evidently at home. The numerous diagrams and photographs of checks, stripes, weaves, yarns, twists, twills, and diagonals, illustrate the descriptions in the text most satisfactorily. The analysis and synthesis of the various "weaves" are particularly well carried out, and constitute the largest and most important part of the volume before us. A scientific journal is, however, not the place for the discussion of such details of manufacture.

A few of the coloured plates are satisfactory; in others the garish hues and harsh associations may, we hope, be attributed to the failure of the chromolithographs to realize the intentions of the author. But some of the coloured figures are deplorably poor, or even thoroughly debased, in design; note particularly Plate xviii.; Plate xxviii., Fig. 2; and Plate xxxi., Fig. 2.

A. H. C.

Constance Naden: a Memoir. By William R. Hughes. (London: Bickers and Son. Birmingham: Cornish Brothers. 1890.)

MISS NADEN was a writer of considerable freshness and ability, and all who knew her agree that she was also a woman of great charm of character. She did not, however, live long enough to produce anything of first-rate importance, and it was hardly advisable to make her the subject of a special memoir. Mr. Hughes appreciates thoroughly all that was most characteristic of his friend's intellectual and moral nature, but he does not possess the secret of presenting brightly and vividly facts in which he himself happens to be interested. Consequently, he does not succeed in conveying any adequate conception even of qualities which he is never tired of praising. The volume contains, besides Mr. Hughes's sketch, an introduction by Prof. Lapworth, and "additions" by Prof. Tilden and Dr. Lewins. The latter gentleman, who delights in the use of an extraordinary philosophical jargon, thinks it would be impossible to be satisfied with any memoir of Miss Naden "which should ignore the scientific hylo-ideal, or automorphic principle, or synthesis underlying and suffusing her whole intellectual and ethical architectonic." He proceeds to supply the necessary exposition, his chief difficulty being "the elementary *naiveté* and simplicity of the concept, or ideal, involved."

Euclid's Elements of Geometry. Arranged by A. G. Layng. (London: Blackie and Son, Ltd., 1890.)

IN this work, Euclid's Books I.-IV., VI., and portions of V. and XI., are dealt with. The enunciations and axioms are the same as those in Simson's edition, but the propositions have received many minor alterations. Only the more common symbols are employed, and some of the propositions have been considerably shortened by the adoption of other proofs based on Euclid's methods. Each proposition is accompanied with examples and in many cases with notes.

An excellent plan adopted throughout is that by which the student can see at a glance the enunciations, propositions, and figures, without the necessity of turning over a page. The appendix contains some simple theorems of modern geometry, a few alternative proofs of the propositions based on other methods than those of Euclid, and a collection of miscellaneous examples and examination papers. Beginners will find the book rather troublesome at first, owing to the use of the symbols; but after these are understood little difficulty ought to be experienced.

LETTERS TO THE EDITOR.

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Hermaphroditism of the Apodidæ.

THE reproduction of *Apus cancriformis* has been a much discussed subject. Although the animal has been well known since the middle of last century, it was not till 1833 that a male was reported to have been found, and not till 1856 that the occasional presence of males in small numbers was certainly established by Kozubowski. On the other hand, the fact that several generations of "females" could be produced without the presence of a male, was established as long ago as 1755 by Schaeffer, who concluded that the animals were hermaphrodite. Since that time authors have been divided in opinion between hermaphroditism and parthenogenesis (not to mention v. Siebold's theory of Thelytoky); the latter view has lately prevailed.[1]

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[1] For the history of this subject see Bronn's "Classen und Ordnungen des Thierreichs," vol. v. On p. 810 the following words occur;—"Untersuchungen über die Gattungen Apus und Daphnia welche offenbar in dem bis zu voller Evidenz geführten Nachweis der Parthenogenetischen Fortpflanzung beider gipfeln." See also Lang's "Lehrbuch der Vergleichende Anatomie," p. 393.

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The animals, however, prove after all to be hermaphrodites. Since the last careful study of *Apus cancriformis*, as a whole, by Zaddach in 1841 (the works of Ray Lankester and others deal only with special points), new methods of research have been introduced into our laboratories which reveal details not easily discoverable by the older methods. Zaddach's figures of the ovaries and testes of Apus are thus naturally somewhat deficient—as deficient, indeed, as the best work we can do to-day will, we hope, be found to be fifty years hence.

As already announced in a preliminary note,[1] published in the current number of the *Jenaische Zeitschrift für Naturwissenschaft* (Band xxv., N.F. xviii.), a small species of Apus kindly handed me by Prof. Kükenthal, and presumably *Lepidurus glacialis*, Kroyer, proved on examination to be hermaphrodite. The specimens were found in East Spitzbergen during the expedition sent thither by the Bremen Geographical Society in 1889, under the conduct of Prof. Kükenthal. The species seemed to be new, as it did not agree with any of the descriptions of *Lepidurus glacialis;* not only was the whole animal much smaller, but its caudal plate was much smaller and not notched at the tip, and, most important of all, it possessed well-developed second antennæ, which have till now never been found in *Lepidurus glacialis* (Huxley's "Anatomy of the Invertebrata," p. 243). The new species, however, proved to be identical with the *L.* "*glacialis*" brought back from West Spitzbergen by Prof. Nathorst, specimens of which were kindly sent me by Prof. Leché, of Stockholm. It thus at first seemed likely that there were two species of Lepidurus in the Arctic regions—a *Lepidurus glacialis* and a *Lepidurus spitzbergensis.* I am now, however, inclined to look upon *L. spitzbergensis* as a stunted variety of *L. glacialis*, or, rather, as a precociously ripe young stage. My reasons for considering it merely a variety of *L. glacialis* are as follows :—

(1) I have succeeded in finding very distinct second antennæ in a large specimen of *L. glacialis*, from Greenland, kindly sent me by the Rev. Canon Norman, so that this supposed difference does not exist. (2) On examination of the genital tube, the sperm-forming centres are found in identically the same place in the two species, viz. at the posterior end of the genital tube, both, in this respect, differing from the other Apodidæ I have as yet had at my disposal to examine. (3) The other two differences—the small size of *L. spitzbergensis* and the undeveloped state of its caudal plate—are, on this supposition, easily accounted for.

We thus have, instead of two Arctic species of Lepidurus, a fully-developed *L glacialis*, Kroyer, presumably in the warmer regions, and a small, precociously developed variety from the colder and more northerly regions—*L. glacialis* var. *spitzbergensis.*

Whether the variety is permanent or not, I have no means of deciding. It is interesting to find that Packard's measurements for *L. glacialis* make it smaller than *L. spitzbergensis* ("Monograph of the North American Phyllopoda," 1883), which shows that *L. glacialis* may be dwarfed by the unfavourable environment. As Packard's drawings are (judging from the development of the caudal plate) of the fully-developed animal, this leads one to think that perhaps, in rather longer summers, the Spitzbergen variety may develop into the typical *L. glacialis* without any great increase of size.

In my preliminary notice announcing the hermaphroditism of *L. spitzbergensis*, knowing how much the reproduction of the Apodidæ had been discussed, I ventured to assert that in all probability the other species of the genus would also prove on closer examination to be hermaphrodite. As above stated, I found the sperm-forming centres in *L. glacialis* in identically the same position as in the Spitzbergen variety. By the kindness of Prof. Möbius, the Director of the new Berlin Museum, and of the Rev. Canon Norman, I have also been able to examine *Apus cancriformis* and *Lepidurus productus*. In both these the sperm-forming centres were found scattered here and there among the rich branchings of the segmental diverticula of the genital tube. They occur either at the tips of such branches, where the eggs ordinarily develop, or as slight lateral bulgings of the same. In all cases the spermatogenesis is the same, the epithelium breaking up into sperm cells ; these escape into the lumen of the tube, and are found in considerable numbers near the genital aperture, where the epithelial lining of the tube is hardly demonstrable, the walls of the tube consisting of a fibrous membrane, in the folds of which the sperm-cells lurk. The eggs are then fertilized as they stretch this membrane in passing out into the egg pouch. The whole richly-branched reproductive organ, with the eggs developing at the tips of the branches, and with here and there a testis, strongly reminds one of a monœcious plant, self-contained, and able to dispense with pollen from without.

I reserve the drawings and the more detailed description of the reproductive organs of the different species for a short comparative study of the Apodidæ which I hope soon to have ready for the press. By way of caution, however, I should here add that small yellowish sacs filled with minute cells occur here and there among the developing eggs. These must not be mistaken for the testes. They are the loci of discharged eggs, and the minute cells are the epithelium cells dislodged by the shrinking of the membrane of the genital tube, which is stretched some 100-fold by the ripening eggs.

The origin of this secondary hermaphroditism is not far to seek ; it is clearly a protection against isolation, as in the case of the Cirripedia and certain parasitic Isopoda. The manner of life of all these animals is such that they are always in danger of being cut off from their kind ; they would thus die out unless able to reproduce either parthenogenetically or by means of self-fertilization.

Some species of Cirripedia, as is well known, have dwarf males, the last remains of the original separation of the sexes. As already mentioned, small males of *Apus cancriformis* are sometimes found. Twelve finds of *A. cancriformis* and *L. productus*, recorded by Gerstaecker, give 4458 "females" (*i.e.* hermaphrodites) to 378 males ; while sixteen finds, numbering 10,000 individuals, did not contain a single male. I have found no record of a male *L. glacialis*, and none of the twenty odd specimens of the Spitzbergen variety I have as yet examined have been males. It is probable that throughout the whole genus self-fertilization is taking the place of cross-fertilization, but that some species have gone further than others in dispensing with males. Two species, for instance, *L. couesii*, Packard, and *L. macrurus*, Lilljeborg, are reported to have more males than "females (?)," but the finds in these cases seem hardly large enough to allow us to judge ; it may have been purely accidental that more males than "females" were caught.

The males of the Apodidæ, with the doubtful exception of *L. productus*, seem to be smaller than the hermaphrodites, otherwise there is no very pronounced sexual dimorphism as there is among the Cirripedia. We are perhaps justified in concluding from this that the hermaphroditism of the Cirripedia is of much older date than that of the Apodidæ. No comparison is here, however, possible, since the two have nothing further in common beyond the fact that they are both hermaphrodite, and that this hermaphroditism is in both cases an adaptation against extermination through too wide dispersion of the individuals.

Jena, January 30. H. BERNARD.

Stereoscopic Astronomy.

THE note on this subject in NATURE of January 22 (p. 269), regarding the perception of stereoscopic effect on examining properly-arranged photographs of Jupiter, recalls an observation which I published in one of a series of articles on physiological optics that appeared in the *American Journal of Science* in 1881 and 1882.

By taking advantage of the moon's librations, Mr. Lewis M. Rutherfurd, of New York, produced more than twenty years ago an excellent stereograph of this heavenly body. In examining this I found it possible to observe not merely the general convexity or concavity, according to the mode of stereoscopic combination, but also the inequalities upon the lunar surface. In an American text-book I have found the statement that Mr. Warren De la Rue had succeeded in obtaining a stereograph of the sun, from which, by stereoscopic vision, the ridges of the faculæ could be perceived in sharp relief. On application to Mr. De la Rue for a copy of this stereograph, I was disappointed to learn that the negative had, unfortunately, been destroyed, and hence no copies were attainable.

My own observations may be given by quoting from the article published in the *American Journal of Science* for May 1882. "On the stereograph of the moon, to which reference has been made, the elevation of mountain ranges and solitary peaks, and even the inequalities of the supposed dead sea bottoms can be clearly seen. The crater Copernicus, and the lunar Apennines, stand forth particularly boldly, and the ridge

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[1] In this note, by an oversight, I stated that Schaeffer concluded the animals to be parthenogenetic.

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